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ABSTRACT

This paper explores three components of academic computing--programming, productivity tools, and computer-based education--by reviewing the past, evaluating the present, and considering the future possibilities of the field. It is suggested that the future growth of academic computing depends upon the resolution of a number of issues: (1) overcoming faculty fear of computers; (2) development of courseware authoring systems; (3) recognition of the pedagogical changes that will need to accompany greater use of courseware; and (4) overcoming the fear of faculty of being replaced by education delivered by computer. (EW)

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A Perspective on Academic Computing Today

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The field of academic computing, especially as it applies to an instructional delivery system, is one with tremendous possibilities. The potential is both broad, across the disciplines, and deep, providing educational opportunities not available a short while ago. It seems timely with the first issue of this publication to discuss this field and to do so in three parts:

1. a review of the past
2. an evaluation of the present
3. a peek into the future.

Further, each of the time frames is broken down into the three components of academic computing:

1. programming
2. productivity tools
3. computer-based education.

This paper is intended to clarify issues, note changes in emphasis, and identify areas of concern as academic computing

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becomes a modus operandi in higher education.

A Review of the Past

It can be argued successfully that the computer is an old product. Didn't Charles Babbage, along with Lady Ada Lovelace, design and build a prototype in the mid-1800's? We can go even further back to the calculating devices of Pascal and Liebnitz developed two centuries earlier. However, the computer as an "impact player" is only 4 decades old. The first books dealing with the history of computers are of recent date. Many of the pioneers in the field are still active participants.

Programming

Perhaps only the programmers who have lived through the development of programming languages can fully appreciate the great advances which have taken place in this component of academic computing. From the academic's viewpoint, the development of more sophisticated languages has until recently permitted the training of large numbers of programmers at the community college level in response to the needs of industry. As languages became more sophisticated, more complex applications could be developed (One airline reservation system took 600,000 lines of coding!)

Productivity Tools

By definition, productivity tools are those which allow the user to become more productive in his/her work. The most salient examples would be software packages for word processing, spreadsheets, data bases, and graphics. The

first two are commonly micro-computer based. None of them was prevalent 15 years ago. All of them have made substantial impact on the way we approach a solution to a problem, whether sending out a "personalized" mailing using a word processor and a data base or creating a spreadsheet for the departmental or home budget. Higher education again has responded to the needs of industry. Workshops and seminars on these products have been extremely popular as well as profitable. For the student, it has meant better papers and more accurate financial documents.

Computer-based Education

The initial work in this area dates back to approximately 1960 with the work of Alpert and Bitzer (PLATO) at the University of Illinois and Bork at the University of California-Irvine. It was tutorial in nature in the beginning, and developed amid some criticism that it was nothing more than electronic page-turning. Interestingly enough, the first courseware (teaching software) developed at Illinois was developed to teach a programming language.

Much of the early work, through the 1970's, was done on a large mainframe computer. PLATO would be a good example of this. During the past decade, there has been an increase in the number of courseware packages which have been developed. Much of this is traced to the advent of micro-computers and, to a lesser extent, to the availability of better courseware authoring systems. Criticism of existing courseware continues apace but it must be recognized that courseware

development has been a significant undertaking. Estimates have been made that 150 - 200 hours of effort are required to create 1 hour of courseware.

Computer-based education differs in a number of respects from programming and productivity tools although it clearly draws on each, articularly the latter, to accomplish its goals. A major difference is that demand for programming and productivity tool training has been largely external. On the other hand, external demand has been non-existent in the computer-based education component. Business and industry looks for educated graduates; how colleges deliver that education has been left to the institutions.

An Evaluation of the Present

On August 12, 1981, IBM announced its first personal computer. A machine configured with two disk drives, monitor, and printer was offered for $4,425. To replace that with a system of equal power would cost 80% less today. We continue to be able to literally get more for less over time. This has allowed us to provide computer access to more and more students for more and more hours. The student who learns word processing in the first semester, for example, is likely to use that capability throughout the college years; we need to respond to that need.

Programming

The programming component as far as an educational enterprise is concerned has fallen on dismal times, reflected most clearly in the decrease in the number of students

majoring in that field. The proliferation of user-friendly main frame software and productivity tools for microcomputers has turned around the long-standing demand for programmer trainees, the typical product of the community and 4-year college curricula. This should not be a surprise. Business and industry has for years recognized programming for what it is, a highly labor-intensive industry. Reducing the programming effort has resulted in decreased labor costs. For academe, it has signaled the need for major curriculum changes.

Productivity Tools

The demand for training in productivity tools appears to have reached a plateau for those schools who now have in place a campus-wide program to handle instruction in word processing, the most popular of the productivity tools, as well as spreadsheets and data bases. The area under discussion now is not whether word processing should be taught to all students; rather the how, who, and when of instruction are the issues of the moment.

Computer-based Education

This component has not approached the mature stage as yet but this in turn is a statement of its potential, not its failure. It is much more complex in scope;it also deals with an almost infinite number of educational specialties. Many, both individuals and corporations, are involved in the creation of courseware which gives computer-based education the appearance of a cottage industry, essentially but not

exclusively. Some curricula have utilized computer-based education for more than a decade. Notable among these success stories is PLATO. During the mid-1970's, the National Science Foundation funded a number of demonstration and implementation sites for the PLATO computer-based education system. Although external funding of these sites ended in 1976, every one of the sites has continued its use of the system. It is only one example of how, once computer-based education is successfully implemented and incorporated, it tends to become a fixture.

A Peek at the Future

Some years ago, a pundit proffered that extending trend lines is dangerous, and to do so in the number of psychologists would result in a projection that within twenty years, every other person in the country would be one. However, its instructive to take a peek so we can have some idea of the potential impact as well as to unearth some challenges along the way.

Programming

The falling-off of a robust demand for programmer graduates, especially at the community colleges, has occurred simultaneously with the need to provide all students with "computer literacy." For the academic, there has been a shift away from the traditional programming curriculum to a service-type department. The number of courses directed toward the non-programming major has increased whether in teaching non-specific productivity tools or tailoring

computer literacy courses to specific fields ("Computer Concepts for Allied Health," "Computer Concepts for Law Enforcement," for example.)

Productivity Tools

Colleges have been involved for the past few years in teaching the big three of productivity tools: word processing, spreadsheets, and data bases. The benefits from such instruction spill over to other courses just as a course in English Composition benefits the student in other courses. The teaching of graphics and desk-top publishing shows promise now and in the near future. Whether the availability of these and similar products will somehow create a demand or that the demand actually exists at the student level is problematical at this time. Even more so will be what academic department will teach these tools.

In an information society such as ours, the need is endemic to become knowledgeable about computers at least to the point of being able to use them wisely and well. As a result, the need to provide such training for our students assures a bright, rewarding, and busy future for those involved in such instruction.

Computer-based Education

Any innovation, and computer-based education would qualify as one, becomes diffused in a predictable manner. It starts out with just a few adopters; subsequently the number of adopters increases at an increasing rate and then increases at a decreasing rate until diffusion is complete.

In effect, a plot of the cumulative number of adopters over time describes an S-shaped curve. What is not predictable is how long it will take for maximum diffusion to take place nor what maximum means in terms of total penetration. (New math diffused quickly but the establishment of kindergarten as the entry point into our educational system took 50 years).

Where does computer-based education reside on the S-shaped curve? Although we are discussing an innovation about a quarter of a century old, diffusion has not been extensive. It is clearly in the early part of the curve but now shows signs of increasing at an increasing rate. Its future growth depends on the resolution of a number of issues. Among them are:

1. Fear of the computer on the part of faculty. This factor appears to be lessening in importance. As faculty see their colleagues, who are not computer professionals using the equipment effectively, computerphobia gives way to a feeling of "if s/he can do it, so can I."
2. Courseware authoring systems. A large number of people would like to incorporate computer-based education in parts of their courses but packaged software does not quite do what is envisioned. The alternative, writing one's own courseware, has heretofore been a time-consuming task. Courseware authoring sytems, like programming languages, go through generations, each succeeding one being more

sophisticated yet more facile to use.

3. The recognition that integrating courseware into a course or curriculum requires, in Piagetian terms, both assimilation of and adaptation to computer-based education. The pedagogy, with a computer-based education component, is going to be different and probably substantially different. Faculty in general are not keen to have new methodologies invade their busy and demanding lives without some assurance that in time the efforts will all be worth it.

4. Fear by faculty of being replaced by education delivered by the computer. Looking at the overall effects of the computer revolution, it is easy to cite instances where people were replaced by computers. However, the college faculty member is not the payroll clerk or the inventory manager. The vulnerability of the faculty member to be replaced by an automated system does not exist. No studies to date show that reduced staffing levels were an outcome of any implementation of computer-based education. Rather, it seems that there will be a restructuring which will probably allocate to teacher and machines roles best handled by each.

Studies show statistically significant results where computer-based education is used. The faculty who exploits those advantages would incur no risk of being replaced. It

is to be hoped that funding for both will continue and increase as the demand for computer-based education grows.

Finally, those who have chosen to use various facets of computer-based education have received excellent feedback from students who have used the process. The statement is true: students like computer-based education. The reasons why are many but serve to encourage faculty to maintain and others to begin adoption of computer-based education in their courses.

Summary

This article has been ambitious in its purpose of surveying academic computing within a necessarily limited framework. Future articles discussing academic computing, particularly computer-based education, are warranted. Faculty need to be encouraged in their efforts and to share their successes with others.

If we were to summarize where we are now, we could say, "well on our way but the way is long." The challenge can best be described by a poster you might have seen. It is of the ocean, dark and foreboding, with a storm imminent. On the horizon and barely noticeable is a small sailing ship. The poster bears the statement, "Ships are safe in the harbor, but that is not what ships are built for." Just so, we are beginning to see the launching (of faculty) into new waters because that's what teaching truly is.